Claims:

1. A regenerable gas filter for filtering gases which comprises a composite material based on at least one open-structured and material-permeable support and having on at least one side of the support and in the interior of the support at least one inorganic component which comprises essentially at least one compound of a metal, a semimetal or a mixed metal with at least one element of main groups III to VII.

2. A regenerable gas filter which comprises a composite material which is obtainable by application of a suspension which comprises at least one inorganic component comprising a compound of at least one metal, a semimetal or a mixed metal with at least one element of main groups III to VII and a sol to an open-structured and material-permeable support and by subsequent heating at least once during which the suspension comprising at least one inorganic component is solidified on or in or on and in the support.

3. A gas filter as claimed in at least one of claims 1 and 2, wherein the composite material or the gas filter is permeable to gases, solids or liquids.

4. A gas filter as claimed in at least one of claims 1 to 3, wherein the open-structured and material-permeable support has intermediate spaces having a size of from 0.02 to 500 µm.

5. A gas filter as claimed in at least one of claims 1 to 4, wherein the support comprises at least one material selected from the group consisting of carbon, metals, alloys, glass, ceramics, minerals, plastics, amorphous substan-

ces, natural products, composite materials or at least one combination of these materials.

6. A gas filter as claimed in at least one of claims 1 to 5, wherein the support comprises at least woven, felted or ceramically bound fibers or at least sintered spheres or particles.

7. A gas filter as claimed in at least one of claims 1 to 6, wherein the support comprises at least one at least partially electrically conductive material.

8. A gas filter as claimed in at least one of claims 1 to 7, wherein the support is perforated.

9. A gas filter as claimed in at least one of claims 1 to 8, wherein the material-permeable support has been made material-permeable by laser treatment or ion beam treatment.

10. A gas filter as claimed in at least one of claims 1 to 9, wherein the support comprises fibers of at least one material selected from the group consisting of carbon, metals, alloys, ceramics, glass, plastics, composite materials, minerals, natural products and amorphous substances or fibers of at least one combination of these materials.

11. A gas filter as claimed in at least one of claims 1 to 10, wherein the support comprises woven fibers of metal or alloys.

12. A gas filter as claimed in at least one of claims 1 to 11, wherein the support comprises at least one woven steel mesh.

13. A gas filter as claimed in at least one of claims 1 to 12, wherein the support comprises at least one woven mesh having a mesh opening of from 5 to 500 µm.

14. A gas filter as claimed in at least one of claims 1 to 13, wherein the support comprises at least one expanded metal having a mesh opening of from 5 to 500 µm.

15. A gas filter as claimed in at least one of claims 1 to 14, wherein the support comprises a sintered metal, a sintered glass or a metal nonwoven having a pore width of from 0.1 to 500 µm.

16. A gas filter as claimed in at least one of claims 1 to 15, wherein the support comprises at least aluminum, silicon, cobalt, manganese, zinc, vanadium, molybdenum, indium, lead, bismuth, silver, gold, nickel, copper, iron, titanium, platinum, stainless steel, steel or brass or an alloy of these materials or a material coated with Au, Ag, Pb, Ti, Ni, Cr, Pt, Pd, Rh, Ru and/or Ti.

17. A gas filter as claimed in at least one of claims 1 to 16, wherein the inorganic component comprising at least one compound of at least one metal, semimetal or mixed metal with at least one element of main groups III to VII or at least one mixture of these compounds comprises at least one compound of the transition elements and of main groups III to VII or at least one compound of the transition elements and at least one compound of main groups III to VII, with the compounds having a particle size of from 0.01 to 25 µm.

18. A gas filter as claimed in at least one of claims 1 to 17, wherein the inorganic component

comprising a compound of at least one metal, at least one semimetal or at least one mixed metal with at least one element of main groups III to VII or a mixture of these compounds comprises at least one compound of an element of transition groups III to VIII or at least one element of main groups III to V with at least one of the elements Te, Se, S, O, Sb, As, P, N, Ge, Si, C, Ga, Al or B or at least one compound of an element of transition groups III to VIII and at least one element of main groups III to V with at least one of the elements Te, Se, S, O, Sb, As, P, N, Ge, Si, C, Ga, Al or B or a mixture of these compounds.

19. A gas filter as claimed in at least one of claims 1 to 18, wherein the inorganic component comprises at least one compound of at least one of the elements Sc, Y, Ti, Zr, V, Cr, Mo, W, Mn, Fe, Co, B, Al, In, Tl, Si, Ge, Sn, Pb, Sb or Bi with at least one of the elements Te, Se, S, O, Sb, As, P, N, C or Ga or at least one of these elements.

20. A gas filter as claimed in at least one of claims 1 to 19, wherein the inorganic component comprises aluminosilicates, aluminum phosphates, zeolites or partially exchanged zeolites.

21. A gas filter as claimed in at least one of claims 1 to 20, wherein the inorganic component comprises amorphous microporous mixed oxides which may contain up to 20% of non-hydrolyzable organic compounds.

22. A gas filter as claimed in at least one of claims 1 to 21, wherein the inorganic component comprises at least aluminum oxide or titanium oxide.

23. A gas filter as claimed in at least one of claims 1 to 22, wherein the composite material comprises at least two particle size fractions of at least one inorganic component.

24. A gas filter as claimed in claim 23, wherein the particle size fractions in the composite material have a particle size ratio of from 1:1 to 1:100.

25. A gas filter as claimed in at least one of claims 23 and 24, wherein the composite material has a ratio of amounts of the particle size fractions of from 0.01:1 to 1:0.01.

26. A gas filter as claimed in at least one of claims 1 to 25, wherein the composite material comprises particle size fractions having an average particle size of from 0.3 to 3 µm.

27. A gas filter as claimed in at least one of claims 1 to 26, wherein the material permeability of the composite material can be limited to particles having a particular maximum size by means of the particle size of the inorganic component used.

28. A gas filter as claimed in at least one of claims 1 to 27, wherein the composite material has pores which are permeable to particles having a maximum size of from 0.1 to 0.5 µm.

29. A gas filter as claimed in at least one of claims 1 to 28, wherein the composite material is bendable.

30. A gas filter as claimed in claim 29, wherein the composite material can be bent to a radius of down to 2 mm.

31. A gas filter as claimed in at least one of claims 1 to 30, wherein the gas filter has the composite material rolled into a suitable container having at least one gas inlet and at least one gas outlet, with the composite material being arranged so that the gas to be filtered must, after entering the gas filter, pass at least once through the composite material before it can leave the gas filter via the gas outlet.

32. A gas filter as claimed in at least one of claims 1 to 31, wherein thermally decomposable solids or liquids which have been filtered from a filtered gas and block the pores of the composite material are removed from the gas filter by baking the gas filter by application of a voltage to the support of the composite material.

33. A gas filter as claimed in at least one of claims 1 to 32, wherein the gas inlet and the gas outlet are provided with a flow- or pressure-measuring device by means of which the pressure or the amount of gas entering and leaving the filter is measured and when a preset difference between the measured values, which represents a measure of the blocking of the composite material, is reached, the baking of the gas filter is commenced.

34. A gas filter as claimed in at least one of claims 1 to 33, wherein the composite material comprises at least one catalytically active component.

35. A gas filter as claimed in claim 34, wherein the composite material comprises, as catalytically active component, at least one inorganic material, at least one metal or at least one organometallic

compound which has catalytically active centers on its surface.

36. A gas filter as claimed in claim 34, wherein the composite material comprises, as catalytic component, a zeolite, silicalite or an amorphous microporous mixed oxide.

37. A gas filter as claimed in claim 34, wherein the composite material comprises, as catalytically active component, at least one oxide of at least one of the elements Mo, Sn, Zn, V, Mn, Fe, Co, Ni, As, Sb, Pb, Bi, Ru, Re, Cr, W, Nb, Hf, La, Ce, Gd, Ga, In, Tl, Ag, Cu, Li, K, Na, Be, Mg, Ca, Sr and Ba.

38. A gas filter as claimed in claim 34, wherein the composite material comprises at least titanium suboxide as catalytically active component.

39. A gas filter as claimed in claim 34, wherein the composite material comprises, as catalytically active component, at least one metal compound selected from among the compounds of the metals Pt, Rh, Ru, Ir, Au, Ag, Os, Re, Cu, Ni, Pd and Co.

40. A gas filter as claimed in claim 34, wherein the composite material comprises, as catalytically active component, at least one metal selected from among the metals Pt, Rh, Ru, Ce, Ir, Au, Ag, Os, Re, Cu, Ni, Pd and Co.

41. A process for producing a gas filter as claimed in any of claims 1 to 40, which comprises producing a material-permeable composite material by applying, in and on at least one open-structured and material-permeable support, at least one suspension which comprises at least one inorganic component comprising at least one compound of at

least one metal, a semimetal or a mixed metal with at least one of the elements of main groups III to VII and a sol and by solidifying the suspension on or in or on and in the support material by subsequent heating at least once.

42. The process as claimed in claim 41, wherein the suspension is applied on and in or else on or in the support by printing, pressing-on, pressing-in, rolling-on, doctor blade coating, painting-on, dipping, spraying or casting.

43. The process as claimed in at least one of claims 41 and 42, wherein an open-structured and material-permeable support comprising a material selected from the group consisting of carbon, metals, minerals, ceramics, composite materials or at least one combination of these materials is used.

44. The process as claimed in at least one of claims 41 to 43, wherein the support comprises at least one material which is at least partially electrically conductive.

45. The process as claimed in at least one of claims 41 to 44, wherein a woven stainless steel mesh is used as support.

46. The process as claimed in at least one of claims 41 to 45, wherein the suspension which comprises at least one inorganic component and at least one metal oxide sol, at least one semimetal oxide sol or at least one mixed metal oxide sol or a mixture of these sols is produced by suspending at least one inorganic component in at least one of these sols.

47. The process as claimed in at least one of claims 41 to 46, wherein the suspension comprises at least one catalytically active component.

48. The process as claimed in at least one of claims 41 to 47, wherein the sols are obtained by hydrolyzing at least one metal compound, a mixed metal compound or at least one semimetal compound using a liquid, a gas or a solid.

49. The process as claimed in claim 48, wherein the liquid, gas or solid used for hydrolyzing the metal compound is water, water vapor, ice, alcohol or an acid or a combination of these compounds.

50. The process as claimed in at least one of claims 48 and 49, wherein the compound to be hydrolyzed is added prior to the hydrolysis to alcohol or an acid or a combination of these liquids.

51. The process as claimed in at least one of claims 48 to 50, wherein at least one metal nitrate, a metal chloride, a metal carbonate, a metal alkoxide compound or at least one semimetal alkoxide compound is hydrolyzed.

52. The process as claimed in claim 51, wherein at least one metal alkoxide compound or at least one semimetal alkoxide compound selected from among the alkoxide compounds of the elements Ti, Zr, Al, Si, Sn, Ce and Y or a metal nitrate, a metal chloride or a metal carbonate selected from among the metal salts of the elements Ti, Zr, Al, Si, Sn, Ce and Y is hydrolyzed.

53. The process as claimed in claim 52, wherein a titanium alkoxide compound is hydrolyzed.

54. The process as claimed in at least one of claims 41 to 53, wherein the hydrolysis of the compounds to be hydrolyzed is carried out using at least half the molar ratio of water, based on the hydrolyzable group of the hydrolyzable compound.

55. The process as claimed in at least one of claims 41 to 54, wherein the hydrolyzed compound is treated with at least one organic or inorganic acid.

56. The process as claimed in claim 55, wherein the organic or inorganic acid has a concentration of from 10 to 60%.

57. The process as claimed in at least one of claims 55 and 56, wherein the hydrolyzed compound is treated with at least one mineral acid selected from the group consisting of nitric acid, sulfuric acid, perchloric acid and hydrochloric acid or a combination of these acids.

58. The process as claimed in at least one of claims 41 to 57, wherein a titanium dioxide sol acidified with mineral acid is used as sol.

59. The process as claimed in at least one of claims 41 to 58, wherein at least one inorganic component having a particle size of from 1 to 10,000 nm is suspended in a sol.

60. The process as claimed in claim 59, wherein an inorganic component comprising at least one compound selected from among metal compounds, semimetal compounds, mixed metal compounds and metal mixed compounds with at least one of the elements of main groups III to VII, or at least one mixture of these compounds, is suspended.

61. The process as claimed in at least one of claims 59 and 60, wherein an inorganic component comprising at least one compound from among the oxides of the transition elements or the elements of main groups III to V is suspended.

62. The process as claimed in claim 61, wherein the oxides are selected from among the oxides of the elements Sc, Y, Ti, Zr, V, Nb, Cr, Mo, W, Mn, Fe, Co, B, Al, In, Tl, Si, Ge, Sn, Pb and Bi.

63. The process as claimed in at least one of claims 41 to 62, wherein at least one inorganic component used is aluminum oxide having a particle size of from 0.3 to 3 µm.

64. The process as claimed in at least one of claims 41 to 63, wherein at least one catalytically active component is incorporated into the composite material.

65. The process as claimed in at least one of claims 41 to 64, wherein at least one catalytically active component is added to the sol.

66. The process as claimed in at least one of claims 41 to 65, wherein at least one catalytically active component having a particle size of from 1 to 10,000 nm is suspended in a sol.

67. The process as claimed in at least one of claims 65 and 66, wherein at least one catalytically active component comprises at least one compound selected from among metal compounds, semimetal compounds, mixed metal compounds and metal mixed compounds with at least one of the elements of main groups III to VII or organic compounds or at least one mixture of these compounds.

68. The process as claimed in at least one of claims 41 to 67, wherein at least one noble metal, a noble metal compound or a zeolite is incorporated as catalytic component into the composite material.

69. The process as claimed in at least one of claims 41 to 68, wherein at least one catalytically active component comprises at least one compound selected from the group consisting of zeolite, silicalite or amorphous mixed oxide.

70. The process as claimed in at least one of claims 41 to 69, wherein the proportion by mass of the suspended components corresponds to from 0.1 to 500 times the hydrolyzed compound used.

71. The process as claimed in at least one of claims 41 to 70, wherein the suspension present on and in or else on or in the support is solidified by heating the composite at least once at from 50 to 1000°C.

72. The process as claimed in claim 71, wherein the composite is subjected to a temperature of from 50 to 100°C for from 10 minutes to 5 hours.

73. The process as claimed in claim 71, wherein the composite is subjected to a temperature of from 100 to 800°C for from 1 second to 10 minutes.

74. The process as claimed in at least one of claims 71 to 73, wherein heating is carried out by means of heated air, hot air, infrared radiation, microwave radiation or electrically generated heat.

75. The process as claimed in at least one of claims 71 to 73, wherein heating is carried out

using the support material as electrical resistance heating element.

76. The process as claimed in at least one of claims 41 to 75, wherein the solidification of the suspension is achieved by applying the suspension on and in a preheated support.

77. The process as claimed in at least one of claims 41 to 76, wherein at least one support is unwound from a roll, passed at a speed of from 1 to 50 m/h through at least one apparatus which applies the suspension on or in or on and in the support and at least one further apparatus which makes possible the solidification of the suspension on or in or on and in the support by heating and the composite material produced in this way is wound up on a second roll.

78. The process as claimed in at least one of claims 41 to 77, wherein an unsintered ceramic or inorganic layer is applied to a support and is strengthened by heating.

79. The process as claimed in at least one of claims 41 to 78, wherein the dried and strengthened composite material is impregnated with a solution comprising at least one metal salt, the composite material which has been treated in this way is dried by heating and the metal salt which is present in and on or else in or on the composite material is reduced to metal.

80. The process as claimed in at least one of claims 41 to 79, wherein a metal salt which is present in the composite material is reduced to metal by treating the composite material with a reducing agent.

81. The process as claimed in claim 80, wherein the reducing agent used is a borohydride.

82. The process as claimed in at least one of claims 41 to 81, wherein a metal salt which is present in or on or else in and on the composite material is reduced to metal by using the composite material as electrode in an electrolysis.

83. The process as claimed in at least one of claims 41 to 82, wherein a material-permeable composite material is introduced into a container having at least two openings.

84. The process as claimed in claim 83, wherein the composite material is introduced into folded or rolled form in the container.

85. The process as claimed in at least one of claims 41 to 84, wherein the composite material is fixed in the container so that a gas flowing through the filter has to pass through the composite material at least once.

86. The process as claimed in claim 85, wherein the composite material is fixed in the container by welding, soldering or adhesive bonding.

87. The process as claimed in at least one of claims 41 to 86, wherein the support in the composite material is connected to at least one power lead.

88. The use of a gas filter as claimed in at least one of claims 1 to 40 for cleaning waste or feed gases.

89. The use of a gas filter as claimed in at least one of claims 1 to 40 for cleaning waste gases from power stations.

90. The use of a gas filter as claimed in at least one of claims 1 to 40 for cleaning the exhaust gases of vehicles driven by internal combustion engines.

91. The use of a gas filter as claimed in at least one of claims 1 to 40 for cleaning the exhaust gases of vehicles driven by diesel engines.

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